

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on September 2, 2008, has been entered.

## **EXAMINER'S AMENDMENT**

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Kenneth Kohn on September 22, 2008.

The application has been amended as follows:

In the Claims:

Claims 1, 2 and 4-24 have been canceled without prejudice.

New claims 25-27 have been added as follows:

25. (New) A method of coating a carbon article with platinum comprising:  
contacting the carbon article with a solution comprising platinum phosphate  
blue and  
performing electrodeposition through cyclic voltammetry, thereby forming a  
platinum coating on the carbon article.
26. (New) The method according to claim 25, wherein the electrodeposition step  
includes immersing the carbon article in the solution.
27. (New) The method according to claim 26, wherein the electrodeposition step  
includes varying electrical potential from about zero volts to about -1.0 volts with a  
rate of potential change of about 100 millivolts per second.

In the Specification:

The paragraph at page 6, lines 26-28 (as numbered by applicant in the  
specification as filed) and printed as paragraph [0022] in Pub No.: US 2006/0234039  
A1 has been amended as follows:

~~[0022]~~ FIG. 2 is a graph showing ~~electrocatalytic polymerization followed by reduction with~~ cyclic voltammograms of platinum phosphate blue recorded using a porous carbon, SCE, and Pt wire as working, reference, and auxiliary electrodes, respectively;

The paragraph at page 6, lines 30-31 in the specification as filed and printed as paragraph [0023] in Pub No.: US 2006/0234039 A1 has been amended as follows:  
~~[0023]~~ FIG. 3 is a graph showing cyclic voltammograms of  $K_3Fe(CN)_6$  recorded utilizing platinum wire and platinum coated carbon electrodes ~~prepared by electrocatalytic polymerization and reduction of Platinum Phosphate blue;~~

The paragraph at page 6, lines 33 to page 7, line 2 in the specification as filed and printed as paragraph [0024] in Pub No.: US 2006/0234039 A1 has been amended as follows:  
~~[0024]~~ FIG. 4 is a graph showing cyclic voltammograms of  $K_3Fe(CN)_6$  recorded utilizing platinum coated electrode or pure platinum wire as a working electrode ~~prepared by electrocatalytic polymerization and reduction of Platinum Phosphate blue;~~

The paragraph at page 7, lines 14-18 in the specification as filed and printed as paragraph [0027] in Pub No.: US 2006/0234039 A1 has been amended as follows:  
~~[0027]~~ Generally, the present invention provides a method of coating a carbon article with a metal, by cyclic voltammetrically electrodepositing ~~electrocatalytic polymerization and reduction of the metal on the carbon article through cyclic voltammetry~~, thereby forming a metal coating on the carbon article. Also provided by the present invention, is the metal-coated carbon article made by the above method.

The paragraph at page 8, lines 8-22 in the specification as filed and printed as paragraph [0031] in Pub No.: US 2006/0234039 A1 has been amended as follows:  
~~[0031]~~ The preferred method of electrodeposition ~~through electrocatalytic polymerization and reduction (hereafter reductive electropolymerization)~~ utilizes voltammetry. Voltammetry utilizes a simple potential waveform that is often used in electrochemical experiments, which is the linear waveform i.e., the potential is continuously changed as a linear function of time. The rate of change of potential with time is referred to as the scan rate (v). The simplest technique that uses this waveform is linear sweep voltammetry. The potential range is scanned in one direction, starting at the initial potential and finishing at the final potential. A more commonly used variation of the technique is cyclic voltammetry, in which the

direction of the potential is reversed at the end of the first scan. Thus, the waveform is usually of the form of an isosceles triangle. The advantage is that the product of the electron transfer reaction that occurred in the forward scan can be probed again in the reverse scan. In addition, it is a powerful tool for the determination of formal redox potentials, detection of chemical reactions that precede or follow the electrochemical reaction, and evaluation of electron transfer kinetics.

The paragraph at page 9, lines 18-33 in the specification as filed and printed as paragraph [0034] in Pub No.: US 2006/0234039 A1 has been amended as follows:  
~~[0034]~~ The method of the present invention provides for coating a carbon article with a metal complexes using ~~reductive electropolymerization through cyclic voltammetry~~ cyclic voltammetric electrodeposition or controlled ~~reductive electropolymerization through cyclic voltammetry~~ potential electrodeposition, thereby forming a metal coating on the carbon article. More specifically, the ~~reductive electropolymerization~~ electrodepositing step includes immersing the carbon article in a solution containing a ~~polymerizable and~~ reducible metal compound. The carbon article and the solution are then subjected to varying electrical potentials, the general principle of which is detailed above. For example, the carbon article and the solution are subjected to varying electrical

potential from about zero volts to about -1.0 volts with a rate of potential change of about 100 millivolts per second. The subjecting step is then repeated until the metal is formed of a sufficient thickness on a surface of the carbon article. The use of ~~reductive electropolymerization through~~ cyclic voltammetry for the electrodeposition of a metal enables an extremely thin coating to be deposited on a carbon article. For example, the metal coating can be deposited of a thickness that is less than about 0.1 mg/cm<sup>2</sup> and most preferably less than 0.08 mg/cm<sup>2</sup>, 0.05 mg/cm<sup>2</sup>, and 0.03 mg/cm<sup>2</sup>.

The paragraph at page 12, line 24 to page 13, line 2 in the specification as filed and printed as paragraph [0044] in Pub No.: US 2006/0234039 A1 has been amended as follows:

~~[0044]~~ FIG. 2 shows the ~~deposition technique based on electrocatalysis leading to polymerization and reduction with~~ cyclic voltammograms recorded by scanning the potential between 0 and -1.0 V for 20 cycles. Each complete cycle consists of a forward and a reverse scan. As can be seen from the diagram, there is a large change in current during the first four cycles. Subsequently, the changes in current from one cycle to the next decrease after several cycles, indicating the completion of electrode modification, in fact, very little change in current is seen after 10 cycles. Although the current did not change significantly after five cycles,

platinum loading continues until it reaches saturation, which requires at least about 20 cycles. Amounts of platinum loaded on carbon surfaces, as determined by ion plasma coupled mass spectrometry (ICP-MS), are listed in Table 1. A uniform coating of the platinum on the carbon surface was observed following the cyclic voltammetry experiments. However, the effective surface area as determined in FIG. 6 is much larger than the geometric surface area of carbon articles. Accordingly, the actual platinum loading is lower than the values provided in Table 1 and in some instances the loading can be three times less for carbon articles.

~~TABLE US 00001 TABLE 1 Coated Platinum Contents on Carbon Surfaces Following Cyclic Voltammetry Platinum Loading mg/cm<sup>2</sup> Carbon Rod/Carbon Paper/Carbon Rod/Carbon Paper/Carbon Paper/No. Of Pb Blue Pt Blue K.sub.2PtCl.sub.4 K.sub.2PtCl.sub.4 K.sub.2PtCl.sub.4 Cycles (Stirring) (Stirring) (Without Stirring) (Without Stirring) (Stirring) 05 0.0448 0.0303—0.0401 0.1146 08 0.0889 ——— 10 0.1198 0.0761—0.0779 0.1838 15 0.1810 0.1176 0.0910 — 20 0.2158 0.1452 0.0980 0.1100 0.2058~~

The paragraph at page 14, lines 15-23 in the specification as filed and printed as paragraph [0046] in Pub No.: US 2006/0234039 A1 has been amended as follows:

~~[0046]~~ The platinum coated carbon electrode made according to this method functions like an authentic platinum electrode as evidenced by the following

experiments. First, cyclic voltammograms were recorded for the reduction of  $K_3Fe(CN)_6$  using a platinum wire and platinum coated carbon electrode prepared from reductive electropolymerization as a working electrode. Identical voltammograms were obtained when the surface area of these two electrodes were equal as shown in FIG. 3. Furthermore, when a platinum coated carbon electrode was also used as an auxiliary electrode, the electrochemical system yielded voltammograms similar to those observed for platinum metal auxiliary electrode as shown in FIG. 4.

In the Title:

--Method of Making--has been inserted at the beginning of the title.

#### COMMENTS

3. Originally presented claims 1, 2 and 4-24 have been canceled without prejudice. It is the position of the Examiner that claims 1, 2, 4, 5 and 24 as presented by applicant in the amendment filed on September 2, 2008, are not allowable for the same reasons given in the final rejection of April 1, 2008. Consequently, to expedite prosecution these claims have been canceled. Additionally, claims 6-23 which are drawn to a non-elected invention have been canceled. New claim 25-27 have been added and are deemed to be patentable over



the prior art of record. See the statement of reasons for allowance below. Basis is found in example 1 at page 12, line 21 to page 13, line 20 of the specification as originally presented. This portion of the specification corresponds to paragraphs [0043] and [0044] as printed in Pub No.: US 2006/0234039 A1. Claims 26 and 27 generally correspond to originally presented claims 2 and 4.

4. For the reasons given in the final rejection, the amendments made to the specification in the amendment filed on December 26, 2007, are considered to have introduced new matter. The specification has been amended to return it to its originally presented form.

5. The title has been amended to correspond to the subject matter of the allowed claims.

6. The following is an examiner's statement of reasons for allowance: As disclosed by applicant in example 1, platinum phosphate blue has a basic unit of  $\text{Pt}_2(\text{NH}_3)_2(\text{HPO}_4)_2$ . See page 12, lines 29-31 of the specification as filed. The prior art of record does not teach or suggest electrodeposition of a platinum coating on a carbon article using cyclic voltammetry from a solution comprising platinum phosphate blue.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to WILLIAM T. LEADER whose telephone number is (571) 272-1245. The examiner can normally be reached on Mondays-Thursdays and alternate Fridays, 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Susy Tsang-Foster can be reached on 571-272-1293. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/William Leader/  
September 25, 2008

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